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EARLY STAGES AND BIOLOGY OF *PHYCIODES ORSEIS* (NYMPHALIDAE)

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THE PURPOSE OF THIS PAPER is to describe the early stages of *Phyciodes orseis*, and to determine its taxonomic relationship with other *Phyciodes*.

A female *P. orseis* from near Glenbrook, Douglas County, Nevada, was confined in 1972 with three suspected composite species. She laid a cluster of about 35 eggs on a *Cirsium* leaf. The larvae were raised to adults on various *Cirsium* species including *C. vulgare*. The larvae ate all *Cirsium* species tried which have thin green mostly glabrous leaves, but they did not eat several Colorado species with thick leaves and woolly white pubescence. Total time from laying of eggs to emergence of adults averaged 51 days for males and 58 days for females (indoors). Pupal stage lasted an average of 10 days for males, 13 days for females. Both sexes emerged in morning.

Egg. Shape as in other *Phyciodes*; barrel shaped, with flattened base and rounded top. Upper sides with about 22 vertical ribs, connected by tiny crossbars. Lower half with many small depressions of the diameter of or slightly less than width between ribs. Top with many polygonal cells. Micropyle with a circular area surrounded by about 9 (9, 9, and 10 in three eggs) cells (Fig. 2). Second and third cell rank progressively larger than rosette cells.

First Instar. Head uniform sclerotic brown, with darker areas internal to ocelli. Body cream. Suranal plate very weakly sclerotized, with a small dark spot (Fig. 3).

Second Instar. Head and body same color as first instar. Dorsal scoli have about 12 setae, scoli below spiracles have about 6 setae. Length of anal scoli about three times basal diameter. Suranal plate very lightly sclerotized.

Third to Sixth Instar. Head capsule black with two cream colored areas: a circular area around a dorsal seta and a stripe on dorsum, extending posteriorly and slightly laterally, length about three times width. The circle and stripe are nearly or partially connected in third instar, separated by diameter of circle in later instars. Some fifth and sixth instar larvae have three lightly sclerotized triangular areas on frontoclypeus (Fig. 1), most have this structure entirely black. Intermediate sized larvae have the color pattern shown in Fig. 1: a mid-dorsal dark line, then a white (sometimes ochre) line; then a maroon-black broad area surrounding subdorsal and supraspiracular scoli (with small whitish spots surrounding tiny setae);

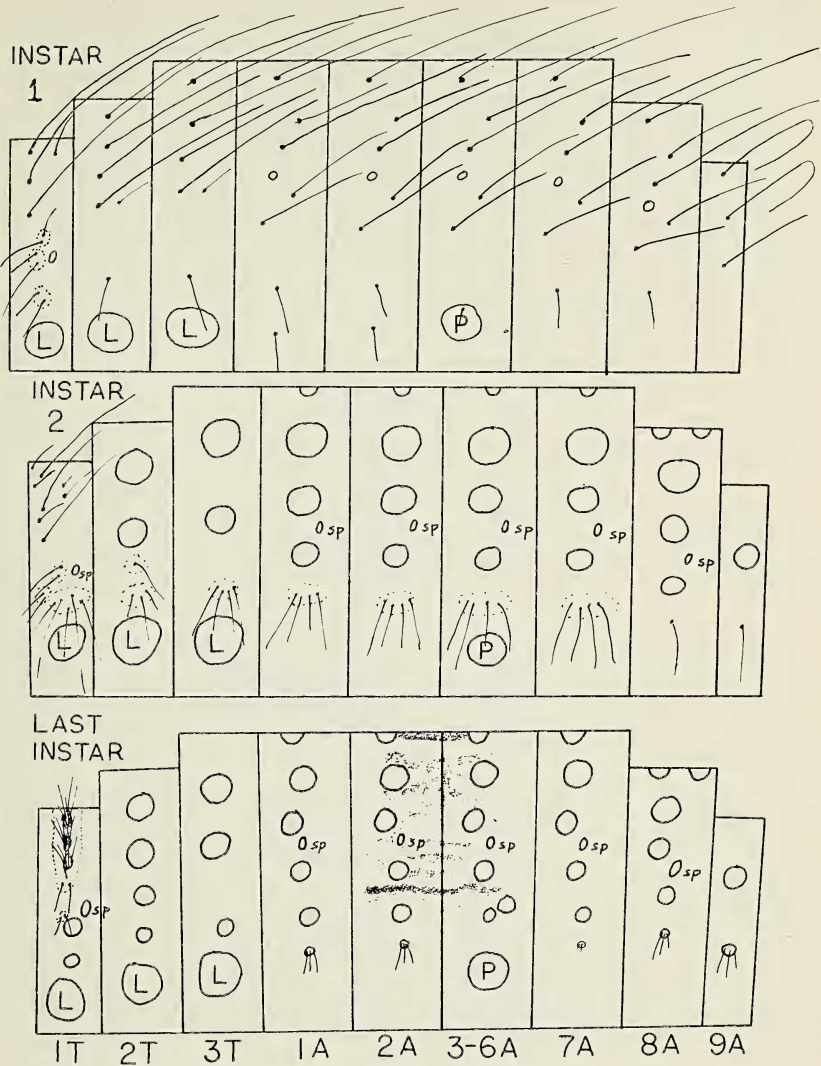


Fig. 1.—Setal pattern of *P. orseis*. Dotted lines surround raised areas of first and second instars, and surround sclerites of mature larva. Circles are scoli, legs (L), or prolegs (P). Color pattern of intermediate sized larva is drawn onto mature larvae setal pattern.

then a white to yellowish white zone surrounding spiracles and lateral scoli with dingy maroon areas inside this whitish area presenting the appearance of several whitish stripes, one just above spiracles and the other running through lateral scoli (there are whitish circular areas surrounding spiracles); a dark dingy maroon stripe below lateral scoli; ventral surface light dingy maroon. In 5-6 instar the maroon-black is widespread over the dorsal half of the larva and nearly or almost completely obscures this pattern. Tiny white spots also occur around tiny setae. In intermediate sized larvae the scoli above spiracles are all black, and scoli below spiracles are ochre colored (sometimes the tips of lateral scoli are black); scoli are all mostly black in mature larva. Setae of scoli are dark brown or black. Dorsal scoli of mature larva with about 25 setae, ventral scoli with only about 10. Length of anal scoli of mature larva only about 2 times basal diameter. Suranal plate of mature larva unsclerotized, ochre, with numerous tiny setae. Lateral anal proleg sclerites of mature larva triangular, with many setae about as long as those of scoli. Prothoracic shield with three raised areas on each side containing many setae.

Pupa. Mottled brown due to tiny light or whitish areas, some dark brown areas, and many tiny brown striations. Some individuals are slightly darker due to larger tiny brown areas. Darker brown mottled patches occur as follows: crossing wing from near end of cell to tornus; on costa near apex; on dorsal edges of flanges of front wing base; on anterior edge of each side of prothoracic tergum; on abdomen two subdorsal spots on each segment, placed near posterior segment and positioned between the more anterior "tubercles"; near base of hindwing; near tornus of hindwing extending dorsally over the segment; on base of eclosion flap. Anterior half of dorsal tubercles brown, posterior half light. Wing cases with narrow brown striations parallel to veins in distal half of wing. Antenna shafts with many and legs with few narrow twinned whitish bands between segments. There are seven equally spaced brown lines on ventral of abdominal segments posterior to wingtips, the dorsalmost lines running through spiracles; reduced to five in some individuals and all very weak in other individuals. There are up to seven postmedian and up to eight marginal tiny whitish wing spots.

Shape as in *P. tharos*. Meso- and metathorax with two raised bumps ("tubercles") subdorsally. Abdominal segments 1-7 with three tubercles, one dorsally and two subdorsally, those of segment 1 weak. Abdominal segment 8 usually with a trace of one anterior dorsal tubercle. Cremaster with a depressed area near crochets (Fig. 2), a slit, and two ventral tubercles near anterior segment, which are circular and raised above the surface about their diameter or slightly greater (longer than dorsal tubercles). Often a black dorsal spot occurs next to crochets. There is a ventral sex mark just behind segment 8 (Fig. 2) which is a small slit bordered by two hemispherical raised areas in males, a slightly longer slit without raised areas in females. Abdominal segment 8 and 9 fused, with a weak dorsal intersegmental groove.

COMPARISON WITH OTHER PHYCIODES

Seasonal and individual variation is considerable in published descriptions (Davenport & Dethier, 1937; Edwards, 1889) but some differences can be noted. *P. tharos* eggs have slightly fewer ribs than other species. First instar prothoracic shield is unsclerotized in *P. orseis*, partly sclerotized in most other species. Larval setal pattern is very similar or identical in all *Phyciodes*. Mature larval color of *P. orseis* is most similar to that of *P.*

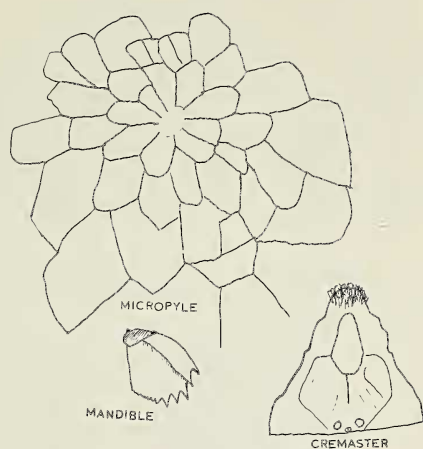


Fig. 2.—Micropyle, cremaster (dorsal view), and right mandible of mature larva (posterior view) of *P. orseis*. Circles on cremaster represent cuticular processes.

mylitta and *P. campestris*, which are rather black, and differs from the brownish, olivaceous, or yellowish brown colors of other published species. The larval color pattern of *P. orseis* differs from *P. phaon* and *P. tharos* (which are fairly similar to each other in body and head pattern) and from *P. texana* which all have light stripes through subdorsal scoli. Body pattern of *P. orseis* is similar to some *P. picta* and *P. campestris* larvae but they also have a light stripe through subdorsal scoli. Only *P. orseis*, *P. mylitta*, and some *P. campestris* larvae have lighter line next to mid-dorsal black line. Body pattern of *P. orseis* is most similar to that of *P. mylitta*. The *P. orseis* head pattern is unlike the whiter heads of *P. phaon* and *tharos*, and unlike the uniformly dark heads of *P. texana*, but it resembles the heads of *P. picta*, *campestris*, and *mylitta*. These three species apparently lack the lower circular spot of *P. orseis*, however (or it was missed by the authors?). Pupae are all similar and are variable in color. *P. orseis* pupae are darker than those of *P. phaon* and *picta* and some *P. campestris* and *P. tharos*. Pupal color of *P. mylitta* is fairly similar to *P. orseis*. In summary, early stages are most similar to *P. mylitta*, which shares with *orseis* the very dark dorsal larval color of later instars, the twinned dorsal whitish line, and most other characteristics.

TAXONOMIC RELATIONSHIP

Although *P. orseis* has often been confused with *P. campestris* in the past, it is actually most closely related to *mylitta* (or *pallida*) in early stages, some aspects of wing pattern, food-plant, and adult behavior. *P. orseis* is a distinct species, as it is sympatric with *P. campestris* and *P. mylitta* near Glenbrook and in the rest of its range (its range is within the range of both latter species) and does not interbreed with them; the reared adults differed from wild *P. orseis* adults only in slightly smaller size.

P. orseis and *P. campestris* show parallel color variation. In northern California and southern Oregon *P. orseis orseis* and *P. campestris campestris* are both dark, and in the Sierra Nevada *P. orseis* subspecies (being described by David L. Bauer) and *P. campestris montana* are light in color. These two *orseis* forms intergrade in the Mt. Shasta area (David Bauer, oral communication), and both *campestris* forms intergrade and often occur in the same meadow. *P. orseis* differs from *campestris* in having falcate forewings, and in having a more distinct pattern of lines on the underside of the hindwing, which resembles *P. mylitta* in *P. orseis orseis*, and is rather uniform pale yellowish in color in *P. orseis* from the Sierra Nevada. *P. campestris* has the hindwing underside without a silvery median band (except in some females), and the lines are usually weakly developed especially distally.

Only *P. orseis* and *P. mylitta* are known to feed on thistle. Other Phyciodes feed on other Compositae, Verbenaceae, or Acanthaceae.

Only *P. orseis*, *P. pallida*, and *P. "batesii"* are single-brooded (May-June), except that *P. campestris* and *P. tharos* are single brooded in the northern part of their range.

The adult behavior of *P. orseis* is most like *P. mylitta* and *P. pallida*. Butterflies use two methods to locate mates (Scott, 1973): perching, in which males sit at characteristic sites and dart out at passing objects in search of females, which fly to these sites to mate, and patrolling, in which males fly almost constantly in search of females. *P. orseis orseis* in the Siskiyou Mountains, California, and *P. orseis* ssp. near Glenbrook have nearly identical behavior and strangely even look alike in flight. Males perch on small shrubs or occasionally on the ground in small depressions between tall riparian vegetation and a hillside. Siskiyou Mts. males usually perch on shrubs

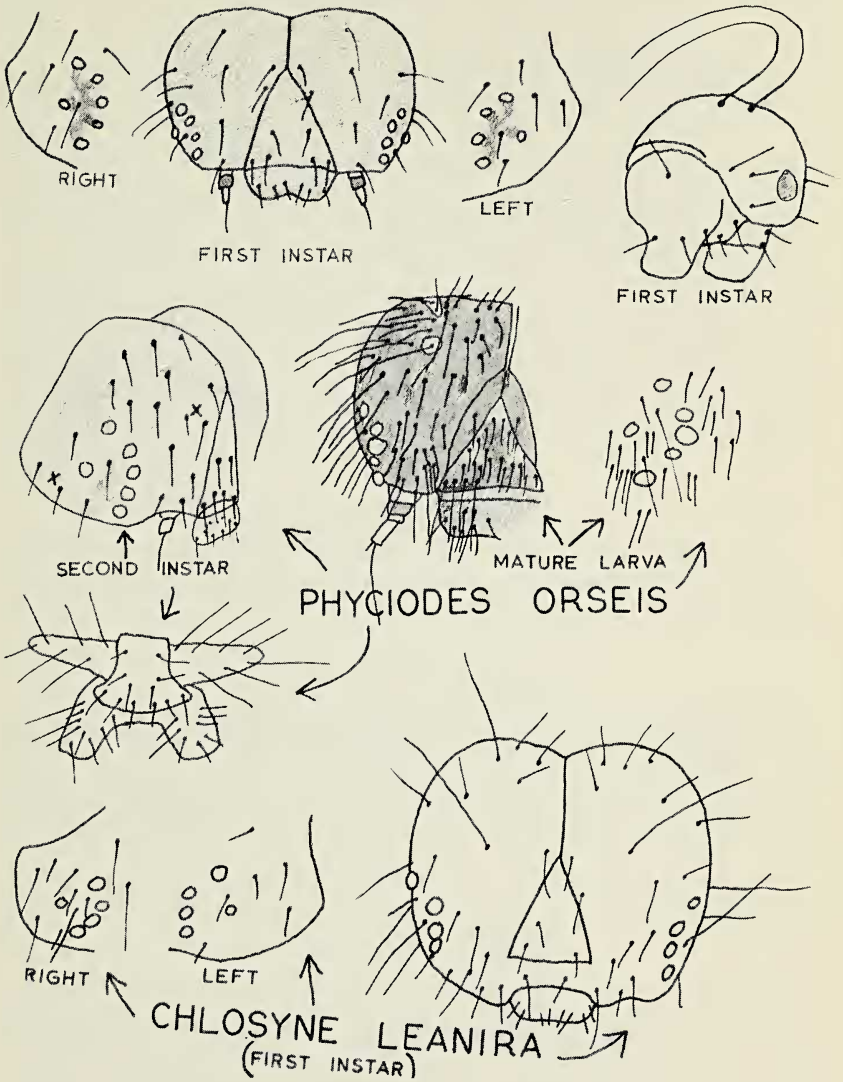


Fig. 3.—Setal pattern of heads of *P. orseis* (and *Chlosyne leanira fulvia* for comparison) (including details of ocellar setae), and oblique or posterior view of terminal segment of *P. orseis* larvae. In second instar *P. orseis* head, the two X's represent setae which are present on some other individuals.

while Sierra Nevada males often perch on or near the ground. Males perch throughout the day, and a copulating pair was found at 1415 (24-hr. ST) at one of these sites near Glenbrook. Only three other *Phyciodes* are known to be perching species. *P. mylitta* perches throughout the day in the same sites near Glenbrook and in small gullies at other localities. *P. pallida* perches all day in small gullies and occasionally patrols on hill-sides and ridges. *P. texana* perches in gullies and stream beds. *P. campestris*, *P. tharos*, *picta*, *phaon*, and *vesta* are all patrolling species; males patrol all day near the ground in fairly flat areas near the larval host, such as meadows, grassy swales, etc.

Actually, *P. orseis* may prove to be more closely related to the allopatric *P. pallida* than to *mylitta*, and may even be a subspecies of *P. pallida*. *P. orseis* from the Sierras is more similar to *P. pallida* than to *P. mylitta* in appearance. The life history of *P. pallida* is unknown, but it probably also feeds on thistle.

ACKNOWLEDGMENTS

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